SRV-HASS Groundwater Flow Model (status update)

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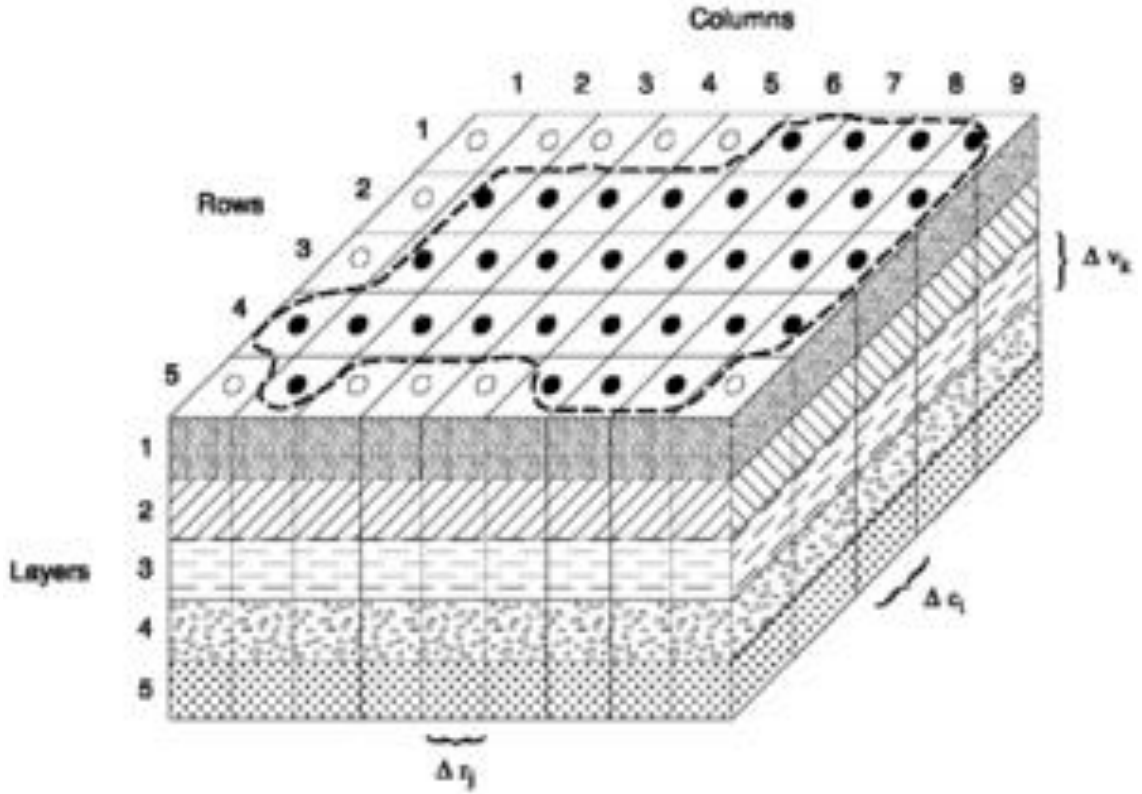
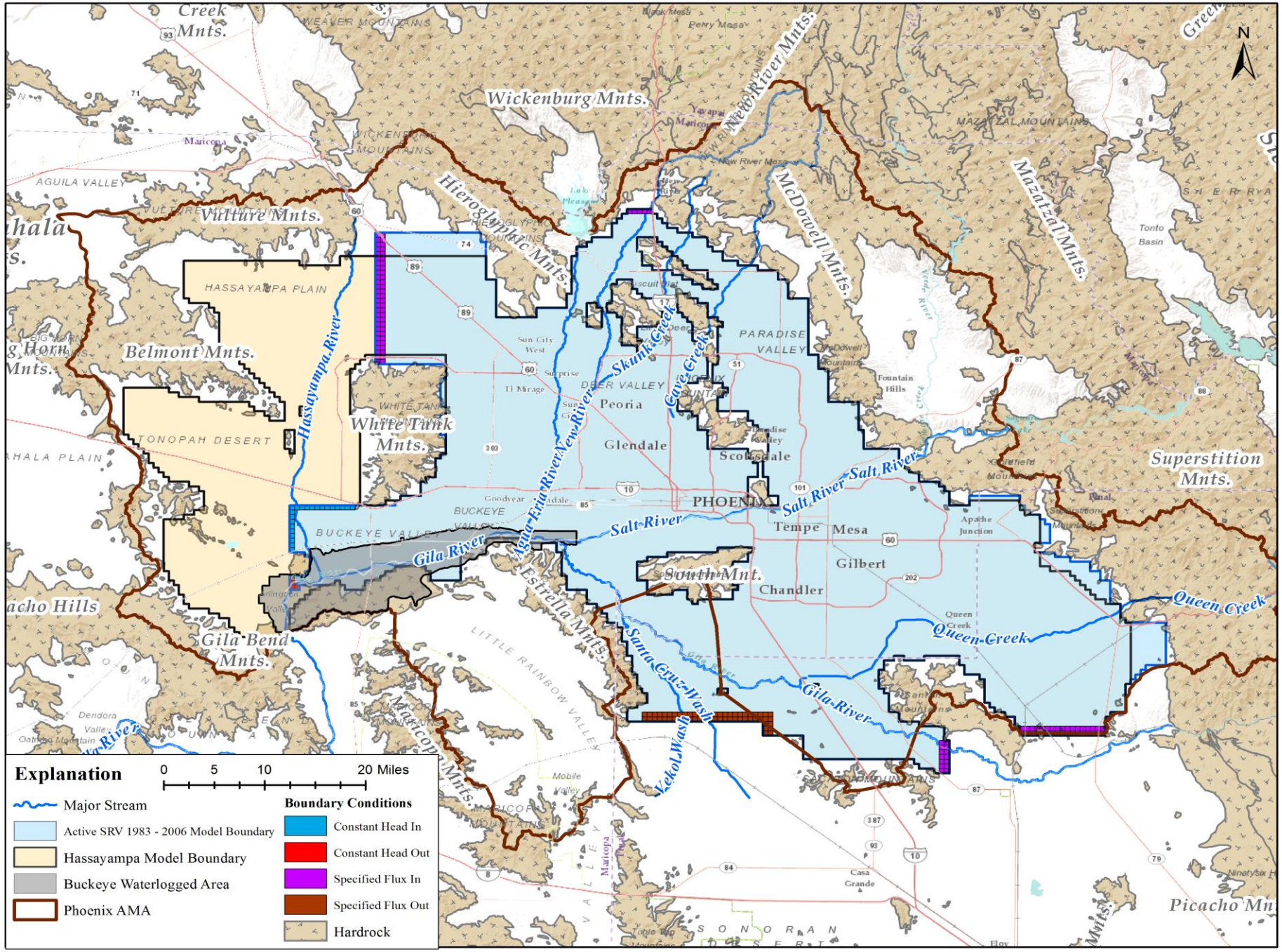
Groundwater Flow Model (GFM)

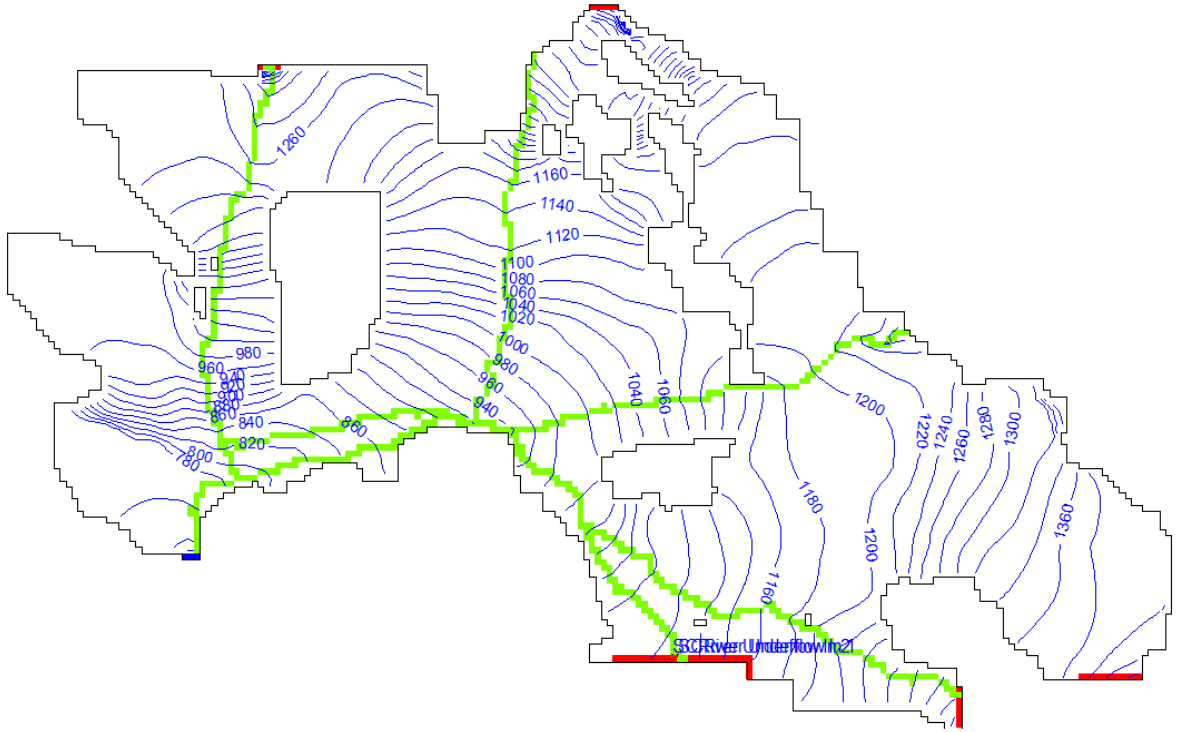
- What is GFM?
  - Approximation of a physical process that occur in the system
  - Understand the impacts of alternative water use
- Model development protocol
  - Model study plan
  - Data and conceptualization
  - Model setup
  - Model calibration
  - Model prediction and uncertainty assessment




Explanation
0 5 10 20 Miles
Major Stream
Active SRV 1983 - 2006 Model Boundary
Hassayampa Model Boundary
Buckeye Waterlogged Area
Phoenix AMA
Boundary Conditions
Constant Head In
Constant Head Out
Specified Flux In
Specified Flux Out
Hardrock
N
Wickenburg Mnts.
Vulture Mnts.
Belmont Mnts.
White Tank Mnts.
Gila Bend Mnts.
Estrella Mnts.
South Mnt.
Superstition Mnts.
McDowell Mnts.
Mazatzal Mnts.
Hieroglyphic Mnts.
Picacho Mnts.
HASSAYAMPA PLAIN
TONOPAH DESERT
BUCKEYE VALLEY
PARADISE VALLEY
DEER VALLEY
LITTLE RAINBOW VALLEY
Hassayampa River
New River
Skunk Creek
Cave Creek
Agua Fria River
Salt River
Gila River
Queen Creek
Santa Cruz Wash
Vekol Wash
PHOENIX
Glendale
Peoria
Scottsdale
Tempe
Mesa
Gilbert
Chandler
Buckeye
Goodyear
Surprise
El Mirage
Sun City West
Fountain Hills
Apache Junction
Casa Grande
Maricopa
Queen Creek
Tonto Basin

SRV-HASS Groundwater Model

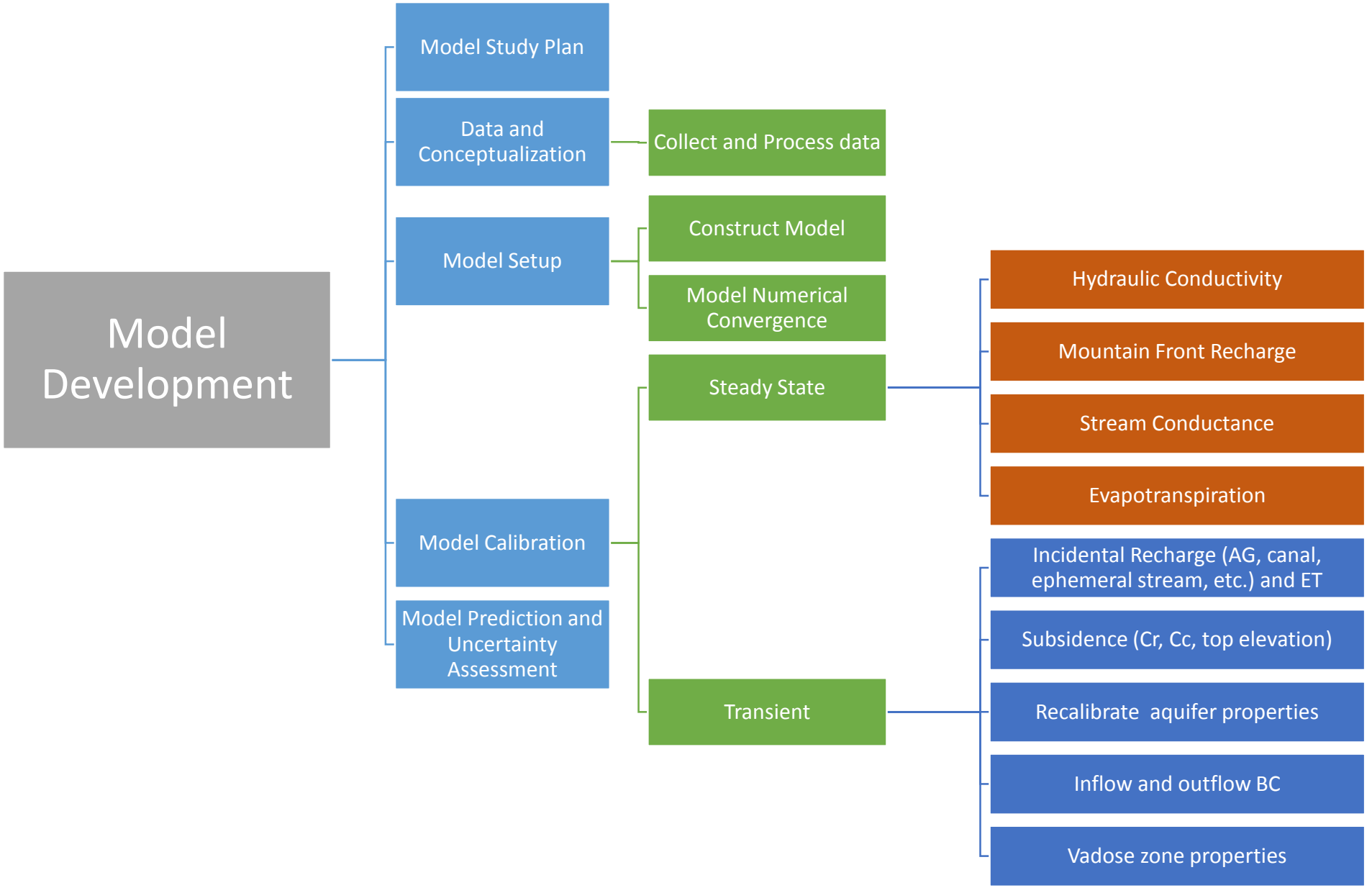
- Initial aquifer properties:
  - Geological update for SRV and Lower Hassayampa (Dubas, 2010)
  - 490 recovery and drawdown pump tests were reviewed and 72 were reanalyzed
  - 6750 well logs were review
  - Natural boundary condition was included



SRV-HASS Groundwater Model

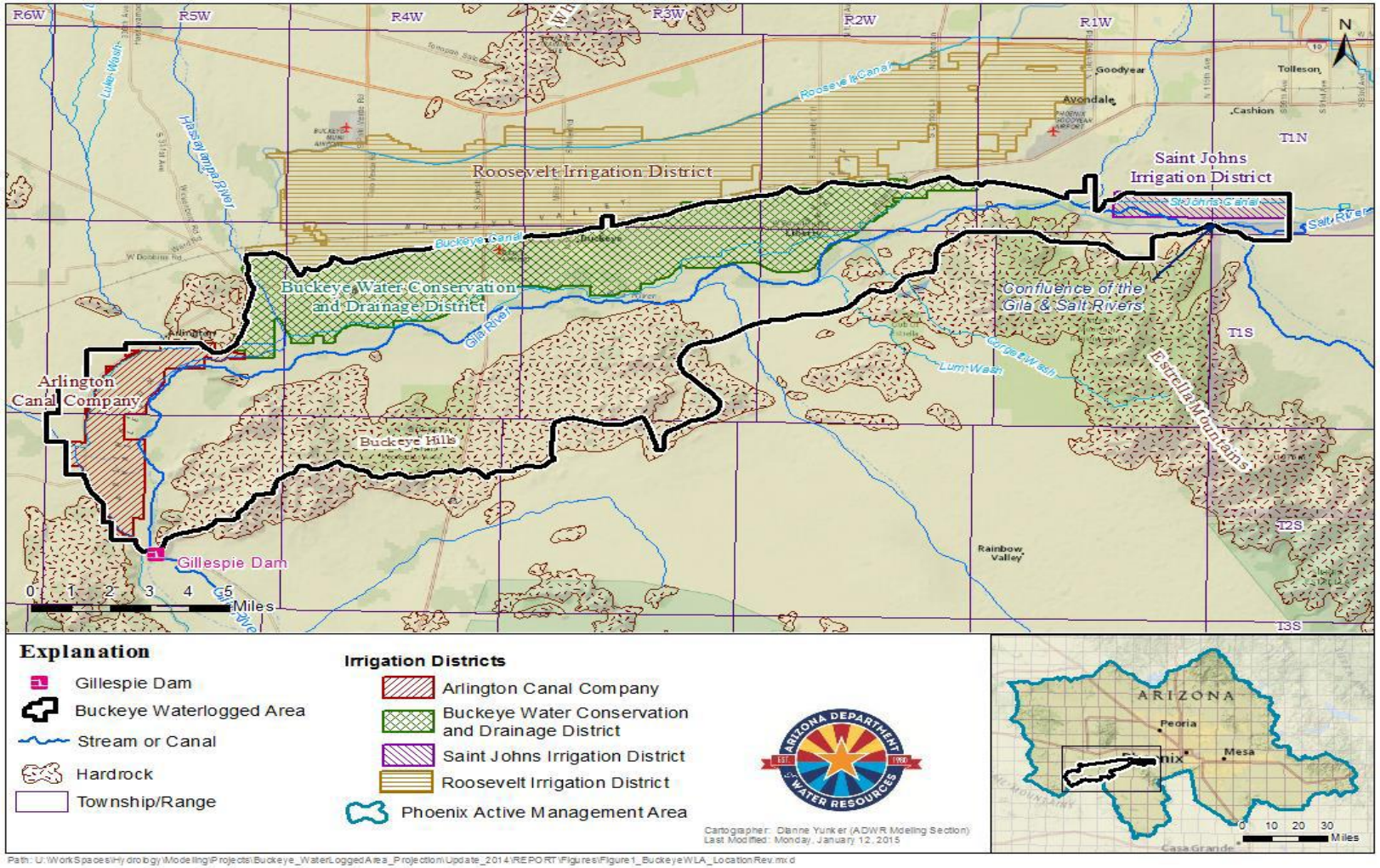
- Model cell space discretization
  - >11000 active cells (1/2 mile)
  - Three layers
- Steady state (Model flow conditions are constant with time)
  - (Pre-development)
    - Hydraulic Conductivity
    - Stream conductance
    - Mountain front recharge
    - Evapotranspiration
- Transient (Model flow conditions changes with time)
  - First period (Pre-development steady state) , second stress period (1900-1922), and annual SP (1923-2015)

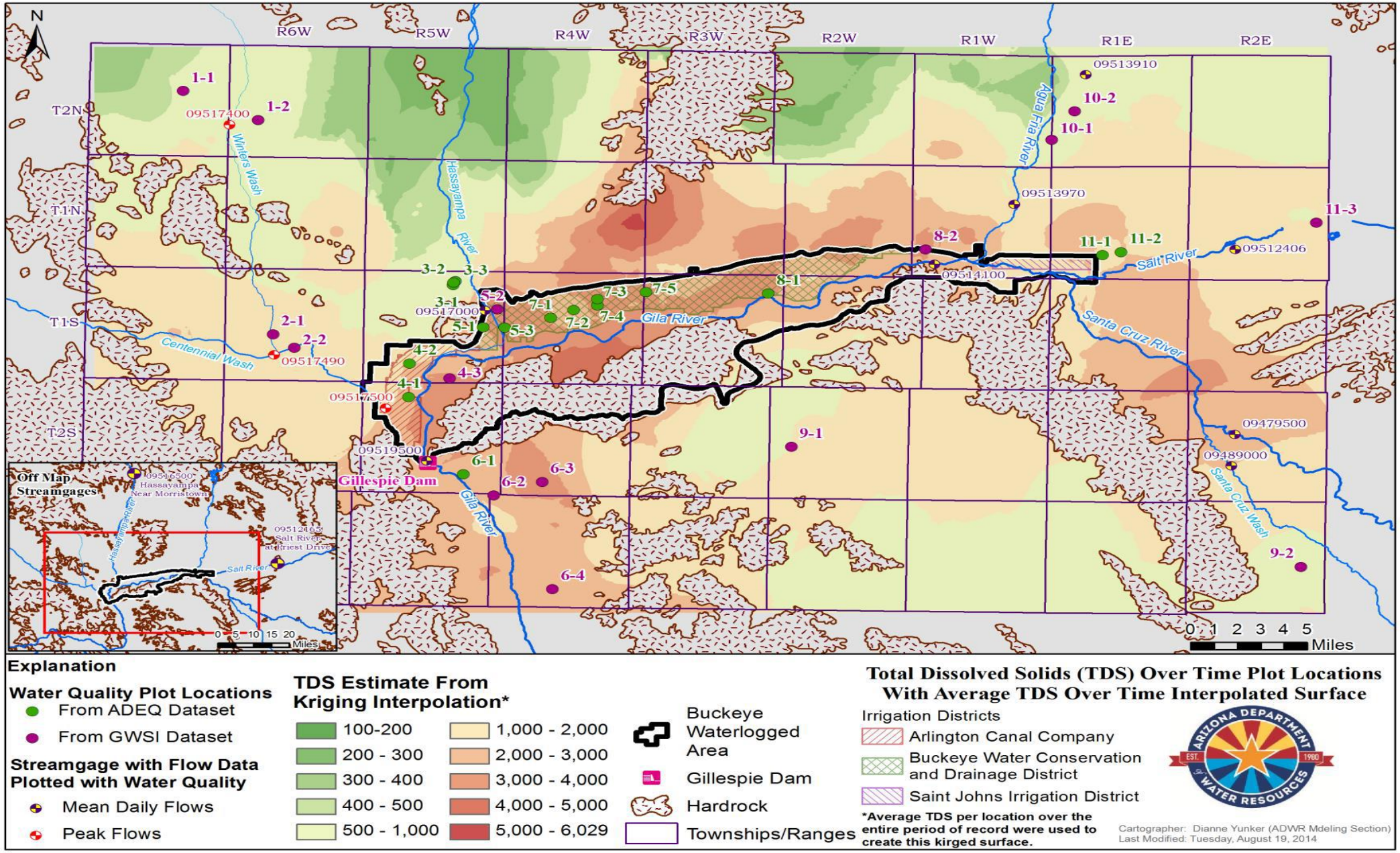
- New Modflow Packages
  - Unsaturated Flow Zone (UZF)
    - Simulates vertical flow of water through the unsaturated zone to the saturated zone.
  - Multi-Node node (MNW)
    - Corrections for the effects of partially penetrating wells
  - Surface Flow Routing (SFR)
    - Flow in the stream is routed to downstream streams
  - Subsidence and Aquifer-System Compaction (SWT)
    - Simulates groundwater storage changes and compaction in a regional groundwater flow model


Model Development
Model Study Plan
Data and Conceptualization
Collect and Process data
Model Setup
Construct Model
Model Numerical Convergence
Model Calibration
Steady State
Hydraulic Conductivity
Mountain Front Recharge
Stream Conductance
Evapotranspiration
Transient
Incidental Recharge (AG, canal, ephemeral stream, etc.) and ET
Subsidence (Cr, Cc, top elevation)
Recalibrate aquifer properties
Inflow and outflow BC
Vadose zone properties
Model Prediction and Uncertainty Assessment

Buckeye Waterlogged Area Analysis

- Determine if the Buckeye area is in a waterlogged state by evaluating groundwater conditions.
- Water levels (1986-2013)





Explanation

Water Quality Plot Locations
- From ADEQ Dataset
- From GWSI Dataset

Streamgage with Flow Data Plotted with Water Quality
- Mean Daily Flows
- Peak Flows

TDS Estimate From Kriging Interpolation*

100-200	1,000 - 2,000
200 - 300	2,000 - 3,000
300 - 400	3,000 - 4,000
400 - 500	4,000 - 5,000
500 - 1,000	5,000 - 6,029

- Buckeye Waterlogged Area
- Gillespie Dam
- Hardrock
- Townships/Ranges

Total Dissolved Solids (TDS) Over Time Plot Locations With Average TDS Over Time Interpolated Surface

Irrigation Districts
- Arlington Canal Company
- Buckeye Water Conservation and Drainage District
- Saint Johns Irrigation District

***Average TDS per location over the entire period of record were used to create this kirged surface.**

Cartographer: Dianne Yunker (ADWR Mdeling Section)
Last Modified: Tuesday, August 19, 2014

- Conclusions
  - Irrigation
    - largest volume
    - Showed more variability
  - Municipal and industrial
    - Steadily grow
    - Small volume
  - Drainage and dewatering pumping
    - Fairly steady
  - Shallow groundwater conditions continue to exist in many parts.

- Recommendations
  - ADWR
    - Exemptions from irrigation water duties, conservation requirements, and groundwater withdrawal fees be extended until the end of the fifth management period (Dec. 31,2024)